

Supersedes ISO TC 184/SC4/W__ N_____

Product data representation and exchange: Application module: Curve Appearance

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ABSTRACT:

This document is a draft of the proposed application module for curve appearance.

KEYWORDS:

module, curve, appearance

COMMENTS TO READER:

This is a sample module for the WG10 STEP Modularization PWI.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 10303-6AE was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 10303 consist of the following parts under the general title *Industrial automation systems and integration — Product data representation and exchange*:

- Part 1, Overview and fundamental principles;
- Part 11, Description methods: The EXPRESS language reference manual;
- Part 12, Description method: The EXPRESS-I language reference manual;
- Part 21, Implementation methods: Clear text encoding of the exchange structure;
- Part 22, Implementation method: Standard data access interface specification;
- Part 23, Implementation method: C++ language binding to the standard data access interface;
- Part 24, Implementation method: C language binding to the standard data access interface;
- Part 26, Implementation method: Interface definition language binding to the standard data access;
- Part 31, Conformance testing methodology and framework: General concepts;
- Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;
- Part 34, Conformance testing methodology and framework: Abstract test methods;
- Part 35, Conformance testing methodology and framework: Abstract test methods for SDAI implementations;

- Part 41, Integrated generic resources: Fundamentals of product description and support;
- Part 42, Integrated generic resources: Geometric and topological representation;
- Part 43, Integrated generic resources: Representation structures;
- Part 44, Integrated generic resources: Product structure configuration;
- Part 45, Integrated generic resource: Materials;
- Part 46, Integrated generic resources: Visual presentation;
- Part 47, Integrated generic resource: Shape variation tolerances;
- Part 49, Integrated generic resource: Process structure and properties;
- Part 101, Integrated application resource: Draughting;
- Part 104, Integrated application resource: Finite element analysis;
- Part 105, Integrated application resource: Kinematics;
- Part 106, Integrated application resource: Building construction core model;
- Part 201, Application protocol: Explicit draughting;
- Part 202, Application protocol: Associative draughting;
- Part 203, Application protocol: Configuration controlled design;
- Part 204, Application protocol: Mechanical design using boundary representation;
- Part 205, Application protocol: Mechanical design using surface representation;
- Part 207, Application protocol: Sheet metal die planning and design;
- Part 208, Application protocol: Life cycle management - Change process;
- Part 209, Application protocol: Composite and metallic structural analysis and related design;
- Part 210, Application protocol: Electronic assembly, interconnect, and packaging design;
- Part 212, Application protocol: Electrotechnical design and installation
- Part 213, Application protocol: Numerical control process plans for machined parts;
- Part 214, Application protocol: Core data for automotive mechanical design processes;

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- Part 215, Application protocol: Ship arrangement;
- Part 216, Application protocol: Ship moulded forms;
- Part 217, Application protocol: Ship piping;
- Part 218, Application protocol: Ship structures;
- Part 221, Application protocol: Functional data and their schematic representation for process plant;
- Part 222, Application protocol: Exchange of product data for composite structures;
- Part 223, Application protocol: Exchange of design and manufacturing product information for casting parts;
- Part 224, Application protocol: Mechanical product definition for process plans using machining features;
- Part 225, Application protocol: Building elements using explicit shape representation;
- Part 226, Application protocol: Ship mechanical systems;
- Part 227, Application protocol: Plant spatial configuration;
- Part 229, Application protocol: Exchange of design and manufacturing product information for forged parts;
- Part 230, Application protocol: Building structural frame: Steelwork;
- Part 231, Application protocol: Process engineering data: Process design and process specification of major equipment;
- Part 232, Application protocol: Technical data packaging core information and exchange;
- Part 301, Abstract test suite: Explicit draughting;
- Part 302, Abstract test suite: Associative draughting;
- Part 303, Abstract test suite: Configuration controlled design;
- Part 304, Abstract test suite: Mechanical design using boundary representation;
- Part 305, Abstract test suite: Mechanical design using surface representation;
- Part 307, Abstract test suite: Sheet metal die planning and design;

- Part 308, Abstract test suite: Life cycle management - Change process;
- Part 309, Abstract test suite: Composite and metallic structural analysis and related design;
- Part 310, Abstract test suite: Electronic assembly, interconnect, and packaging design;
- Part 312, Abstract test suite: Electrotechnical design and installation;
- Part 313, Abstract test suite: Numerical control process plans for machined parts;
- Part 314, Abstract test suite: Core data for automotive mechanical design processes;
- Part 315, Abstract test suite: Ship arrangement;
- Part 316, Abstract test suite: Ship moulded forms;
- Part 317, Abstract test suite: Ship piping;
- Part 318, Abstract test suite: Ship structures;
- Part 321, Abstract test suite: Functional data and their schematic representation for process plant;
- Part 322, Abstract test suite: Exchange of product data for composite structures;
- Part 323, Abstract test suite: Exchange of design and manufacturing product information for casting parts;
- Part 324, Abstract test suite: Mechanical product definition for process plans using machining features;
- Part 325, Abstract test suite: Building elements using explicit shape representation;
- Part 326, Abstract test suite: Ship mechanical systems;
- Part 327, Abstract test suite: Plant spatial configuration;
- Part 329, Abstract test suite: Exchange of design and manufacturing product information for forged parts;
- Part 330, Abstract test suite: Building structural frame: Steelwork;
- Part 331, Abstract test suite: Process engineering data: Process design and process specification of major equipment;
- Part 332, Abstract test suite: Technical data packaging core information and exchange;
- Part 501, Application interpreted construct: Edge-based wireframe;

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- Part 502, Application interpreted construct: Shell-based wireframe;
- Part 503, Application interpreted construct: Geometrically bounded 2D wireframe;
- Part 504, Application interpreted construct: Draughting annotation;
- Part 505, Application interpreted construct: Drawing structure and administration;
- Part 506, Application interpreted construct: Draughting elements;
- Part 507, Application interpreted construct: Geometrically bounded surface;
- Part 508, Application interpreted construct: Non-manifold surface;
- Part 509, Application interpreted construct: Manifold surface;
- Part 510, Application interpreted construct: Geometrically bounded wireframe;
- Part 511, Application interpreted construct: Topologically bounded surface;
- Part 512, Application interpreted construct: Faceted boundary representation;
- Part 513, Application interpreted construct: Elementary boundary representation;
- Part 514, Application interpreted construct: Advanced boundary representation;
- Part 515, Application interpreted construct: Constructive solid geometry;
- Part 517, Application interpreted construct: Mechanical design geometric presentation;
- Part 518, Application interpreted construct: Mechanical design shaded presentation.

The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of the International Standard reflects its structure:

- Parts 11 to 12 specify the description methods,
- Parts 21 to 26 specify the implementation methods,
- Parts 31 to 35 specify the conformance testing methodology and framework,
- Parts 41 to 49 specify the integrated generic resources,
- Parts 101 to 106 specify the integrated application resources,
- Parts 201 to 232 specify the application protocols,

- Parts 301 to 332 specify the abstract test suites, and
- Parts 501 to 518 specify the application interpreted constructs.

Should further parts be published, they will follow the same numbering pattern.

Annex A, B, C, D, and E form an integral part of this part of ISO 10303. Annexes F, G, H, J, and K are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, application modules, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the application module series.

This part of ISO 10303 specifies an application module for curve appearance.

Industrial automation systems and integration — Product data representation and exchange — Part 6AE: Application module: Curve appearance

1 Scope

This part of ISO 10303 specifies the application module for associating curves with appearance characteristics.

The following are within scope of this part of ISO 10303:

- the association of appearance information to curves.

The following are outside the scope of this part of ISO 10303:

- all things which are not involved in the complete specification of curve appearance.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 8824-1:1994, *Information technology — Open systems interconnection — Abstract syntax notation one (ASN.1) — Part 1: Specification of basic notation*.

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*.

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*.

ISO/CD 10303-43, *Industrial automation systems and integration — Product data representation and exchange — Part 43: Integrated generic resource: Representation structures*

ISO 10303-46, *Industrial automation systems and integration — Product data representation and exchange — Part 46, Integrated generic resources: Visual presentation*

ISO/CD 10303-517, *Industrial automation systems and integration — Product data representation and exchange — Part 517, Application interpreted construct: Mechanical design geometric presentation*;

3 Definitions

This part of ISO 10303 makes use of the following terms defined in ISO 10303-1.

- application;
- application protocol;
- data;
- information;
- integrated resource;
- product data;
- structure.

4 Information requirements

This clause specifies the information requirements for curve appearance.

EXPRESS specification:

```
*)  
SCHEMA curve_appearance_arm;  
(*
```

The information requirements are specified as a set of units of functionality, and EXPRESS definitions. The information requirements are defined using the terminology of the subject area of this application module.

- A graphical representation of the information requirements is given in annex C.
- The mapping table is specified in 5.1 which shows how the information requirements are met using the integrated resources of this International Standard. The use of the integrated resources introduces additional requirements which are common to application modules and protocols.

4.1 Units of Functionality

This subclause specifies the units of functionality (UoF) for the shape appearance, layers and groups application module as well as any support elements needed for the module definition. This part of ISO 10303 specifies the following unit of functionality:

- curve_appearance.

This part of ISO 10303 uses the following units of functionality:

- elemental_shape;
- colour.

The units of functionality and a description of the functions that each UoF supports are given below. The module objects included in the UoFs are defined in clause 4.4.

4.1.1 curve_appearance

The curve_appearance UoF specifies the presentation of point, vector, and curve geometry with attributes, such as colour, curve thickness, or curve font.

The following application entities are defined by the curve_appearance UoF:

- Curve_appearance;
- Point_appearance;
- Vector_appearance.

4.1.2 elemental_shape

See ISO 10303-6AB.

4.1.3 colour

See ISO 10303-6AD.

4.2 Referenced AM ARMs

The following EXPRESS reference statements specify the objects imported from the ARMs of other modules.

EXPRESS specification:

```
* )
REFERENCE FROM colour_arm;
REFERENCE FROM elemental_shape_arm;
( *
```

4.3 Application type definitions

This subclause specifies the application types for the curve appearance module. Each application type specifies a data type or selection of data types. The application types and their definitions are given below.

4.3.1 Curve_appearance_select

A Curve_appearance_select identifies the objects which can have appearance.

EXPRESS specification:

```
* )
TYPE curve_appearance_select = SELECT
    (curve_appearance, point_appearance, vector_appearance);
```

```
END_TYPE;  
(*
```

4.4 Application entity definitions

This subclause specifies the application entities for the curve appearance module. Each application entity is an atomic element that embodies a unique application concept and contains attributes specifying the data elements of the object. The application entities and their definitions are given below.

4.4.1 Colour

See ISO 10303-6AD.

4.4.2 Curve_appearance

A Curve_appearance governs the visual appearance of geometric curves and annotation curves.

EXPRESS specification:

```
*)  
ENTITY curve_appearance;  
  width          : REAL;  
  font           : curve_font;  
  colour         : colour;  
END_ENTITY; -- curve_appearance  
(*
```

Attribute definitions:

width: The **width** specifies breadth of the rendered **curve**.

font: The **font** specifies the display pattern of a curve. The font determines the visible and invisible segments of a curve.

colour: The **colour** specifies the colour of the visible segments of a curve.

4.4.3 Curve_font

A Curve_font is a shape replicated at a fixed pattern used to render a curve.

EXPRESS specification:

```
*)  
ENTITY curve_font  
  SUPERTYPE OF (ONEOF (externally_defined_curve_font,  
                       predefined_curve_font,  
                       user_defined_curve_font));  
  curve_font_name : STRING;  
END_ENTITY; -- curve_font  
(*
```

Attribute definitions:

curve_font_name: The word or group of words by which the Curve_font is known.

4.4.4 Curve_font_pattern

A Curve_font_pattern is a semaphore pattern (on-off) in the appearance of a curve.

EXPRESS specification:

```
* )
ENTITY curve_font_pattern;
  on_segment : REAL;
  off_segment : REAL;
END_ENTITY; -- curve_font_pattern
(*
```

Attribute definitions:

on_segment: The numerical length of the drawn segments.

off_segment: The numerical length of the blank segments.

4.4.5 Externally_defined_curve_font

An Externally_defined_curve_font is a Curve_font defined by an outside source.

EXPRESS specification:

```
* )
ENTITY externally_defined_curve_font
  SUBTYPE OF (curve_font);
  curve_font_reference : STRING;
END_ENTITY; -- externally_defined_curve_font
(*
```

Attribute definitions:

curve_font_reference: The identification of the curve font in the external reference.

4.4.6 Externally_defined_marker

An Externally_defined_marker is a Marker defined by an outside source.

EXPRESS specification:

```
* )
ENTITY externally_defined_marker
  SUBTYPE OF (marker);
  marker_reference : STRING;
END_ENTITY; -- externally_defined_marker
```

(*

Attribute definitions:

marker_reference: The identification of the **marker** in the external reference.

4.4.7 Externally_defined_terminator

An Externally_defined_terminator is a Terminator with its shape defined by an outside source.

EXPRESS specification:

```
*)
ENTITY externally_defined_terminator
  SUBTYPE OF (terminator);
  terminator_reference : STRING;
END_ENTITY; -- externally_defined_terminator
(*
```

Attribute definitions:

terminator_reference: The identification of the Terminator in the external reference.

4.4.8 Marker

A Marker is a visual identifier.

EXPRESS specification:

```
*)
ENTITY marker
  SUPERTYPE OF (ONEOF (externally_defined_marker,
                       predefined_marker,
                       user_defined_marker));
  marker_name : STRING;
END_ENTITY; -- marker
(*
```

Attribute definitions:

marker_name: The word or group of words by which the Marker is known.

4.4.9 Point_appearance

A Point_appearance governs the visual appearance of a point.

EXPRESS specification:

```
*)
ENTITY point_appearance;
  marker : marker;
  colour : colour;
```

```

size : REAL;
END_ENTITY;
( *

```

Attribute definitions:

marker: The marker specifies the point marker that shall be used to present a point.

colour: The colour specifies the Colour (See 4.4.1) of a point.

size: The size specifies the breadth of the marker.

4.4.10 Predefined_curve_font

A Predefined_curve_font is a Curve_font which is defined in ISO 10303. Since its definition is standard, it is interchanged by name.

EXPRESS specification:

```

* )
ENTITY predefined_curve_font
  SUBTYPE OF (curve_font);
WHERE
  WR1: SELF.curve_font_name IN ['continuous',
                                'chain',
                                'chain double dash',
                                'dashed',
                                'dotted'];
END_ENTITY; -- predefined_curve_font
( *

```

Formal propositions:

WR1: The **curve_font_name** of the **predefined_curve_font** shall be 'continuous', 'chain', 'chain double dash', 'dashed', or 'dotted'

Attribute value definitions:

Table 1 states the lengths of each segment and space in millimetres.

Table 1 - Predefined curve font segment lengths

Curve pattern name	Segment (mm)	Space (mm)	Segment (mm)	Space (mm)	Segment (mm)	Space (mm)	Number of segments
Continuous							0
Dashed	4.0	1.5					2
Chain	7.0	1.0	1.0	1.0			4
Chain double dash	7.0	1.0	1.0	1.0	1.0	1.0	6
Dotted	1.0	1.0					2

4.4.11 Predefined_marker

A Predefined_marker is a Marker which is defined in ISO 10303. Since its definition is standard, it is interchanged by name.

EXPRESS specification:

```
*)
ENTITY predefined_marker
  SUBTYPE OF (marker);
WHERE
  WR1: SELF.marker_name IN ['asterisk',
                             'circle',
                             'dot',
                             'plus',
                             'square',
                             'triangle',
                             'x'];
END_ENTITY; -- predefined_marker
(*
```

Formal propositions:

WR1: The **marker_name** of the **predefined_marker** shall be 'asterisk', 'circle', 'dot', 'plus', 'square', 'triangle', or 'x'.

Attribute value definitions:

The predefined_marker are:

asterisk: a graphical symbol depicted as three line segments of equal length that intersect at their midpoints forming the origin of the symbol. One of the segments is parallel to the vertical axis of the coordinate system into which the symbol is placed. The other two segments are at angles of 60 and 120 degrees from the first segment, rotated about the origin.

circle: a graphical symbol depicted as a circle. The origin of the symbol is the geometric centre of the circle.

dot: a graphical symbol depicted as a circle with a fill-pattern applied to it. The origin of the dot symbol is the centre of the circle.

plus: a graphical symbol depicted as two perpendicular line segments. The origin of the symbol is the intersection point of the two lines.

square: a graphical symbol depicted as an even-sided rectangle. The origin of the symbol is the geometrical centre of the rectangle.

triangle: a graphical symbol depicted as three line segments that form an equilateral triangle. The origin of the triangle corresponds to the geometric centre of the triangle. One side of the triangle is parallel to the horizontal axis of the coordinate system into which the symbol is placed.

x: a graphical symbol depicted as two line segments of equal length that intersect at their midpoints forming the origin of the symbol. One line segment is at an angle of 45 degrees to the vertical axis of the coordinate system into which the symbol is placed. The other segment is perpendicular to the first.

4.4.12 Predefined_terminator

A Predefined_terminator is a Terminator which is defined in ISO 10303. Since its definition is standard, it is interchanged by name.

EXPRESS specification:

```

*)
ENTITY predefined_terminator
  SUBTYPE OF (terminator);
WHERE
  WR1: SELF.terminator_name IN ['blanked arrow',
                                'blanked box',
                                'dimension origin',
                                'filled arrow',
                                'filled box',
                                'filled dot',
                                'integral symbol',
                                'open arrow',
                                'slash',
                                'unfilled arrow'];
END_ENTITY; -- predefined_terminator
(*

```

Formal propositions:

WR1: The name of the predefined_terminator shall be 'blanked arrow', 'blanked box', 'blanked dot', 'dimension origin', 'filled arrow', 'filled box', 'filled dot', 'integral symbol', 'open arrow', 'slash', or 'unfilled arrow'.

Attribute value definitions:

The predefined_terminators are:

blanked arrow: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is blanked.

blanked box: a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area within the symbol is blanked.

blanked dot: a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is blanked.

dimension origin: a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle.

filled arrow: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is shaded.

filled box: a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area that lies within the symbol is shaded.

filled dot: a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is shaded.

integral symbol: a graphical symbol depicted as one line segment forming two adjacent arcs. The origin of the symbol is the midpoint between the two arcs.

open arrow: a graphical symbol depicted as three line segments which form an isosceles triangle where the third side of the triangle is blanked. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

slash: a graphical symbol depicted as a line segment with the midpoint of the segment being the origin and lying on the annotation curve to which it is applied.

unfilled arrow: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

4.4.13 Terminator

A Terminator is the shape that denotes the end of a construct.

EXPRESS specification:

```
* )
ENTITY terminator
  SUPERTYPE OF (ONEOF (externally_defined_terminator,
                       predefined_terminator,
                       user_defined_terminator));
  terminator_name : STRING;
END_ENTITY; -- terminator
(*
```

Attribute definitions:

terminator_name: The word or group of words by which the Terminator is known.

4.4.14 User_defined_curve_font

A User_defined_curve_font is a Curve_font which is defined independently of any standard or convention.

EXPRESS specification:

```
*)
ENTITY user_defined_curve_font
  SUBTYPE OF (curve_font);
  pattern      : SET [1:?] OF curve_font_pattern;
  segment_symbol : geometric_model;
END_ENTITY; -- user_defined_curve_font
(*
```

Attribute definitions:

pattern: The **pattern** defines the set of semaphore patterns that define the curve font.

segment_symbol: The **segment_symbol** defines the shape of the drawn portions of the **curve_font_pattern**.

4.4.15 User_defined_marker

A User_defined_marker is a Marker which is defined independently of any standard or convention.

EXPRESS specification:

```
*)
ENTITY user_defined_marker
  SUBTYPE OF (marker);
  symbol : geometric_model;
END_ENTITY; -- user_defined_marker
(*
```

Attribute definitions:

symbol: The **symbol** defines the shape of the Marker.

4.4.16 User_defined_terminator

A User_defined_terminator is a Terminator which is defined independently of any standard or convention.

EXPRESS specification:

```
*)

ENTITY user_defined_terminator
  SUBTYPE OF (terminator);
  symbol : geometric_model;
END_ENTITY; -- user_defined_terminator
(*
```

Attribute definitions:

symbol: The **symbol** defines the shape of the Terminator.

4.4.17 Vector_appearance

A Vector_appearance is the definition of the visual appearance of a vector.

EXPRESS specification:

```
* )  
ENTITY vector_appearance;  
  terminator_type    : terminator;  
  vector_font       : curve_font;  
  colour            : colour;  
  width             : REAL;  
END_ENTITY; -- vector_appearance
```

```
END_SCHEMA;  
(*
```

Attribute definitions:

terminator_type: The terminator_type specifies the type of the Terminator.

vector_font: The vector_font specifies the font of the vector line. The font determines the visible and invisible segments and the shape of the segments of the vector line.

colour: The colour specifies the Colour of the visible segments of the vector.

width: The width specifies the breadth of the vector.

5 Module Interpreted Model

5.1 Mapping Table

This clause contains the mapping table that shows how each UoF and application entity of this part of ISO 10303 (see 4) maps to one or several MIM resource constructs. The mapping table is organized in five columns. The contents of these five columns are:

Column 1) Application element: Name of an application element as it appears in the application entity definition. Application entity names are written in uppercase. Attribute names are listed after the application entity to which they belong and are written in lower case.

Column 2) MIM element: Name of an MIM element as it appears in the MIM, the term 'IDENTICAL MAPPING', or the term 'PATH'. MIM entities are written in lower case. Attribute names of MIM entities are referred to as <entity name>.<attribute name>. The mapping of an application element may result in several related MIM elements. Each of these MIM elements will require a line of its own in the table. The term 'IDENTICAL MAPPING' indicates that both application entities of an application assertion map to

the same MIM element. The term 'PATH' indicates that the application assertion maps to the entire reference path.

Column 3) Source: For those MIM elements that are interpreted from the integrated resources, this is the number of the corresponding part of ISO 10303. For those MIM elements that are created for the purpose of this part of ISO 10303, this is the number of this part.

Column 4) Rules: One or more numbers may be given which refer to rules that apply to the current MIM element or reference path. For rules that are derived from relationships between application entities, the same rule is referred to by the mapping entries of all the involved MIM elements. The expanded names of the rules are listed after the table.

Column 5) Reference path: To describe fully the mapping of an application entity, it may be necessary to specify a reference path through several related MIM elements. The reference path column documents the role of a MIM element relative to the MIM element in the row succeeding it. Two or more such related MIM elements define the interpretation of the integrated resources that satisfies the requirement specified by the application entity. For each MIM element that has been created for use within this part of ISO 10303, a reference path up to its supertype from an integrated resource is specified.

For the expression of reference paths and the relationships between MIM elements, the following notational conventions apply:

[] : multiple MIM elements or sections of the reference path are required to satisfy an information requirement;

() : multiple MIM elements or sections of the reference path are identified as alternatives within the mapping to satisfy an information requirement;

{ } : enclosed section constrains the reference path to satisfy an information requirement;

-> : attribute references the entity or select type given in the following row;

<- : entity or select type is referenced by the attribute in the following row;

[i] : attribute is an aggregation of which a single member is given in the following row;

[n] : attribute is an aggregation of which member n is given in the following row;

=> : entity is a supertype of the entity given in the following row;

<= : entity is a subtype of the entity given in the following row;

= : the string, select or enumeration type is constrained to a choice or value;

\ : the line continuation for strings that wrap.

Table 2 - Mapping table curve_appearance UoF

Application_element	MIM element	Source	Rules	Reference path
COLOUR	colour	6AD		
CURVE_- APPEARANCE	curve_style	46		
curve_appearance to colour (as colour)	PATH			curve_style curve_style.curve_colour -> colour
curve_appearance to curve_font (as font) #1 user defined #2 predefined #3 externally defined	PATH			curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select #1 (curve_style_font_select = curve_style_font curve_style_font <= user_defined_curve_font) #2 (curve_style_font_select = pre_defined_curve_font pre_defined_curve_font => draughting_pre_defined_curve_font) #3 (curve_style_font_select = externally_defined_curve_font externally_defined_curve_font)
width	curve_style.curve_- width	46		curve_style curve_style.curve_width -> size_select (size_select = measure_with_unit measure_with_unit => length_measure_with_unit)

Table 1 - Mapping table curve_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
				(size_select = positive_length_measure)
CURVE_FONT	curve_style_font	46		
curve_font_name	curve_style_- font.name	46		
CURVE_FONT_- PATTERN	curve_style_font_- pattern	46		
on_segment	curve_style_font_- pattern.visible_- segment_length	46		
off_segment	curve_style_font_- pattern.invisible_- segment_length	46		
EXTERNALLY_- DEFINED_CURVE_- FONT	externally_defined_- curve_font	46		curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select curve_style_font_select curve_style_font_select = externally_defined_curve_font
curve_font_name	externally_defined_- curve_font.item_id	46		curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select curve_style_font_select curve_style_font_select = externally_defined_curve_font

Table 1 - Mapping table curve_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
				externally_defined_curve_font.item_id
curve_font_reference	PATH			curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select curve_style_font_select curve_style_font_select = externally_defined_curve_font externally_defined_curve_font.source
EXTERNALLY_- DEFINED_MARKER	externally_defined_- marker	6AE		externally_defined_marker <= [pre_defined_marker] [externally_defined_symbol]
marker_name	externally_defined_- marker.item_id	6AE		externally_defined_marker <= externally_defined_symbol<= externally_defined_item.item_id
marker_reference	PATH			externally_defined_marker <= externally_defined_symbol<= externally_defined_item.source-> external_source.source_id
EXTERNALLY_- DEFINED_- TERMINATOR	externally_defined_- terminator_symbol	6AE		externally_defined_terminator_symbol<= externally_defined_symbol
terminator_name	externally_defined_- terminator_- symbol.item_id	6AE		externally_defined_terminator_symbol <= externally_defined_symbol<= externally_defined_item.item_id
terminator_reference	PATH			externally_defined_terminator_symbol <= externally_defined_symbol<=

Table 1 - Mapping table curve_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
				externally_defined_item..source-> external_source.source_id
MARKER	marker_select	46		point_style.marker -> marker_select
marker_name	NO MAPPING			
POINT_- APPEARANCE	point_style	46		
size	point_style.marker_- size			
point_appearance to colour (as colour)	point_style.marker_- colour	46		point_style point_style.marker_colour -> colour
point_appearance to marker (as marker) #1 predefined #2 externally defined #3 user defined	point_style.marker	6AE		point_style.marker -> marker_select #1(marker_select = marker_type) #2(marker_select = pre_defined_marker pre_defined_marker => externally_defined_marker) #3(marker_select = pre_defined_marker pre_defined_marker => user_defined_marker)
PREDEFINED_- CURVE_FONT	draughting_pre_- defined_curve_font	6AE		
curve_font_name	draughting_pre_- defined_curve_- font.name	6AE		
PREDEFINED_- MARKER	marker_type	46		point_style.marker -> marker_select

Table 1 - Mapping table curve_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
				marker_select = marker_type
marker_name	NO MAPPING	46		
PREDEFINED_- TERMINATOR	pre_defined_- terminator_symbol	6AE		pre_defined_terminator_symbol<= pre_defined_symbol
terminator_name	pre_defined_- terminator_- symbol.name	6AE		pre_defined_terminator_symbol<= pre_defined_symbol
TERMINATOR	terminator_select	6AE		
terminator_name	NO MAPPING			
USER_DEFINED_- CURVE_FONT	user_defined_curve_- font	6AE		user_defined_curve_font<= [curve_style_font] [mapped_item]
curve_font_name	user_defined_curve_- font.name	6AE		user_defined_curve_font<= curve_style_font.name
user_defined_curve_- font to curve_font_- pattern (as pattern)	PATH			user_defined_curve_font<= curve_style_font.pattern_list-> curve_style_font_pattern
user_defined_curve_- font to geometric_- model (as segment_- symbol)	PATH			user_defined_curve_font<= mapped_item.mapping_source-> representation_map.mapped_representation-> representation-> shape_representation
USER_DEFINED_- MARKER	user_defined_marker	6AE		user_defined_marker<= [pre_defined_marker] [mapped_item]
marker_name	user_defined_marker	6AE		user_defined_marker<= pre_defined_marker.name

Table 1 - Mapping table curve_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
user_defined_marker to geometric_model (as symbol)	PATH			user_defined_curve_font<= mapped_item.mapping_source-> representation_map.mapped_representation-> representation-> shape_representation
USER_DEFINED_TERMINATOR	user_defined_terminator_symbol	6AE		user_defined_terminator_symbol<= [pre_defined_symbol] [mapped_item]
terminator_name	curve_style_curve_pattern_set.name	46		user_defined_terminator_symbol<= pre_defined_symbol.name
user_defined_terminator to geometric_model (as symbol)	curve_style_curve_pattern.pattern	46		user_defined_terminator_symbol<= mapped_item.mapping_source-> representation_map.mapped_representation-> representation-> shape_representation
VECTOR_APPEARANCE	vector_style	6AE		vector_style <= [pre_defined_symbol] [curve_style]
width	vector_style.curve_width	46		vector_style <= curve_style.curve_width
vector_appearance to terminator (as terminator_type)	PATH			vector_style <= pre_defined_terminator_symbol <= pre_defined_symbol
vector_appearance to colour (as colour)	PATH			vector_style <= curve_style curve_style.curve_colour -> colour
vector_appearance to	PATH			vector_style <=

Table 1 - Mapping table curve_appearance UoF (continued)

Application_element	MIM element	Source	Rules	Reference path
curve_font (as vector_font) #1 user defined #2 predefined #3 externally defined				curve_style curve_style.curve_font -> curve_font_or_scaled_curve_font_select curve_font_or_scaled_curve_font_select = curve_style_font_select #1 (curve_style_font_select = curve_style_font curve_style_font <= user_defined_curve_font) #2 (curve_style_font_select = pre_defined_curve_font pre_defined_curve_font => draughting_pre_defined_curve_font) #3 (curve_style_font_select = externally_defined_curve_font)

5.2 MIM EXPRESS short listing

This clause specifies the EXPRESS schema that uses elements from the integrated resources or application interpreted constructs and contains the types, entity specializations, rules, and functions that are specific to this part of ISO 10303. This clause also specifies modifications to the textual material for constructs that are imported from the integrated resources. The definitions and EXPRESS provided in the integrated resources or application interpreted constructs for constructs used in the MIM may include select list items and subtypes which are not imported into the MIM. Requirements stated in the integrated resources or application interpreted constructs which refer to such items and subtypes apply exclusively to those items which are imported into the MIM.

EXPRESS specification:

```

*)
SCHEMA curve_appearance_mim;
  USE FROM presentation_appearance_schema -- ISO 10303-46
    (curve_style,
     curve_style_font,
     curve_style_font_pattern,
     externally_defined_curve_font,
     marker_select,
     marker_type,
     predefined_curve_font,
     pre_defined_marker,
     point_style);
  USE FROM presentation_definition_schema -- ISO 10303-46
    (pre_defined_symbol,
     externally_defined_symbol);
  USE FROM colour_mim; -- ISO 10303-6AD
  USE FROM elemental_shape_mim; -- ISO 10303-6AB
( *

```

NOTES

- 1 - See annex D for a graphical presentation of this schema using the EXPRESS-G notation.
- 2 - The schema referenced above can be found in the following part of ISO 10303:

presentation_appearance_schema	ISO 10303-46
presentation_definition_schema	ISO 10303-46
presentation_resource_schema	ISO 10303-46
colour_mim	ISO 10303-6AD
elemental_shape_mim	ISO 10303-6AB

5.2.1 Fundamental concepts and assumptions

The following assumptions apply to the portions of this schema that deal with curve appearance: Appearance properties may be applied to points, curves or vector instances.

5.2.2 Module type definitions

This subclause contains the EXPRESS type definitions in the module.

5.2.2.1 terminator

A **terminator** selects a type of symbol to end a construct.

EXPRESS specification:

```
*)
TYPE terminator = SELECT
  (externally_defined_terminator_symbol,
   pre_defined_terminator_symbol,
   user_defined_terminator_symbol);
END_TYPE;
(*
```

5.2.3 Module entity definitions

This subclause contains the EXPRESS entity definitions in the module.

5.2.3.1 draughting_pre_defined_curve_font

A **draughting_pre_defined_curve_font** is a **pre_defined_curve_font** that is identified by a name.

NOTE - This definition is the same as that in 10303-517.

EXPRESS specification:

```
*)
ENTITY draughting_pre_defined_curve_font
  SUBTYPE OF (pre_defined_curve_font);
WHERE
  WR1: SELF.name IN
    [ 'continuous',
      'chain',
      'chain double dash',
      'dashed',
      'dotted' ];
END_ENTITY;
(*
```

Formal propositions:

WR1: The name of the **draughting_pre_defined_curve_font** shall be 'continuous', 'chain', 'chain double dash', 'dashed', or 'dotted'.

Attribute definitions:

Table 1 states the lengths of each line segment and space, in millimetres.

5.2.3.2 externally_defined_marker

An **externally_defined_marker** is a type of **externally_defined_symbol** which is a marker.

EXPRESS specification:

```
*)
ENTITY externally_defined_marker
  SUBTYPE OF (externally_defined_symbol, pre_defined_marker);
END_ENTITY;
(*
```

5.2.3.3 externally_defined_terminator_symbol

An **externally_defined_terminator_symbol** is a type of **externally_defined_symbol**.

EXPRESS specification:

```
*)
ENTITY externally_defined_terminator_symbol
  SUBTYPE OF (externally_defined_symbol);
END_ENTITY;
(*
```

5.2.3.4 pre_defined_terminator_symbol

A **pre_defined_terminator_symbol** is a type of **pre_defined_symbol** that presents a terminator and is identified by name.

EXPRESS specification:

```
*)
ENTITY pre_defined_terminator_symbol
  SUBTYPE OF (pre_defined_symbol);
WHERE
  WR1: SELF.name IN ['blanked arrow', 'blanked box',
    'blanked dot', 'dimension origin', 'filled arrow',
    'filled box', 'filled dot', 'integral symbol',
    'open arrow', 'slash', 'unfilled arrow'];
END_ENTITY;
(*
```

Formal propositions:

WR1: The **name** of the **pre_defined_terminator_symbol** shall be 'blanked arrow', 'blanked box', 'blanked dot', 'dimension origin', 'filled arrow', 'filled box', 'filled dot', 'integral symbol', 'open arrow', 'slash', or 'unfilled arrow'.

Attribute value definitions:

The **pre_defined_terminator_symbols** are:

blanked arrow: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is blanked.

blanked box: a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area within the symbol is blanked.

blanked dot: a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is blanked.

dimension origin: a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle.

filled arrow: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides. The area within the symbol is shaded.

filled box: a graphical symbol depicted as four line segments which form a square. Two opposite sides of the square are parallel to the annotation curve to which the symbol is applied. The origin of the symbol is the geometric centre of the square. The area that lies within the symbol is shaded.

filled dot: a graphical symbol depicted as a circle. The origin of the symbol is the centre of the circle. The area within the symbol is shaded.

integral symbol: a graphical symbol depicted as one line segment forming two adjacent arcs. The origin of the symbol is the midpoint between the two arcs.

open arrow: a graphical symbol depicted as three line segments which form an isosceles triangle where the third side of the triangle is blanked. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

slash: a graphical symbol depicted as a line segment with the midpoint of the segment being the origin and lying on the annotation curve to which it is applied.

unfilled arrow: a graphical symbol depicted as three line segments which form an isosceles triangle. The origin of the symbol corresponds to the intersection point of the two equal sides. The annotation curve, to which the symbol is applied, acts as a bisector to the angle created by the two equal sides.

5.2.3.5 user_defined_curve_font

A **user_defined_curve_font** is a curve font defined independently of any standard or convention.

EXPRESS specification:

```

*)
ENTITY user_defined_curve_font
  SUBTYPE OF (curve_style_font, mapped_item);
END_ENTITY;
( *

```

5.2.3.6 user_defined_marker

A **user_defined_marker** is a marker defined independently of any standard or convention.

EXPRESS specification:

```

*)
ENTITY user_defined_marker
  SUBTYPE OF (pre_defined_marker, mapped_item);
END_ENTITY;
( *

```

5.2.3.7 user_defined_terminator_symbol

A **user_defined_terminator_symbol** is a terminator defined independently of any standard or convention.

EXPRESS specification:

```

*)
ENTITY user_defined_terminator_symbol
  SUBTYPE OF (pre_defined_symbol, mapped_item);
END_ENTITY;
( *

```

5.2.3.8 vector_style

A **vector_style** is a type of **curve_style** and **pre_defined_terminator_symbol** that defines the visual appearance of a vector.

EXPRESS specification:

```

*)
ENTITY vector_style
  SUBTYPE OF (curve_style, pre_defined_terminator_symbol);
END_ENTITY;
END_SCHEMA; -- curve_appearance
( *

```


Annex B
(normative)
Information object registration

B.1 Document identification

To provide for unambiguous identification of an information object in an open system, the object identifier
{ iso standard 10303 part(6AE) version(0) }

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

B.2 Schema identification

To provide for unambiguous identification of the schema specification given in this application module curve-appearance-schema in an open information system, the object identifiers are assigned as follows:

{ iso standard 10303 part(6AE) version(0) object(1) curve-appearance-schema(1) }

is assigned to the curve_appearance schema.

{ iso standard 10303 part(6AE) version(0) object(1) colour-schema(2) }

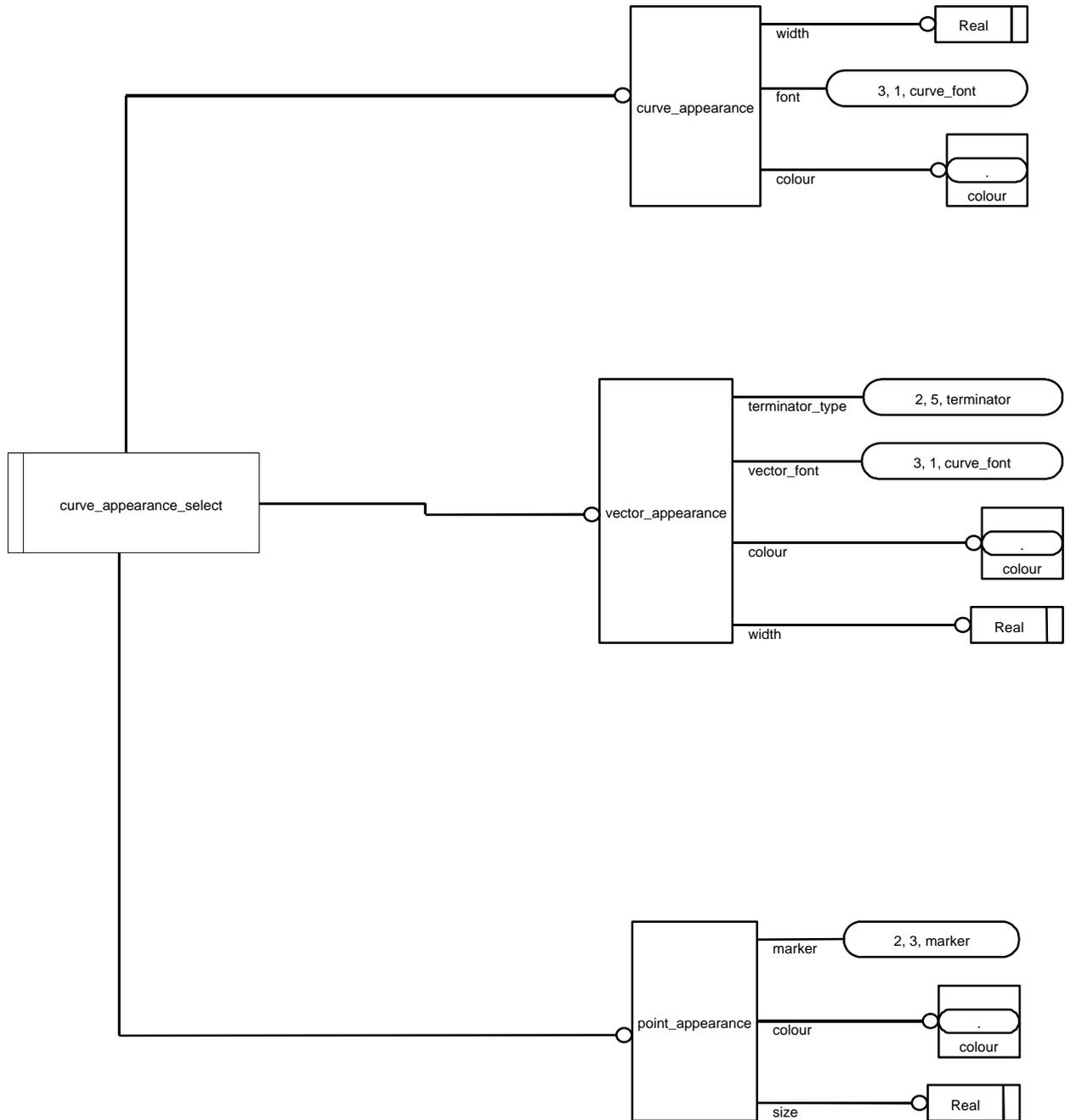
is assigned to the curve_appearance schema short form schema (see 5.2).

The meaning of this value is defined in ISO 8824-1, and is described in ISO 10303-1.

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Annex C
(informative)
ARM EXPRESS-G

Figure C.1 - ARM diagram 1 of 3



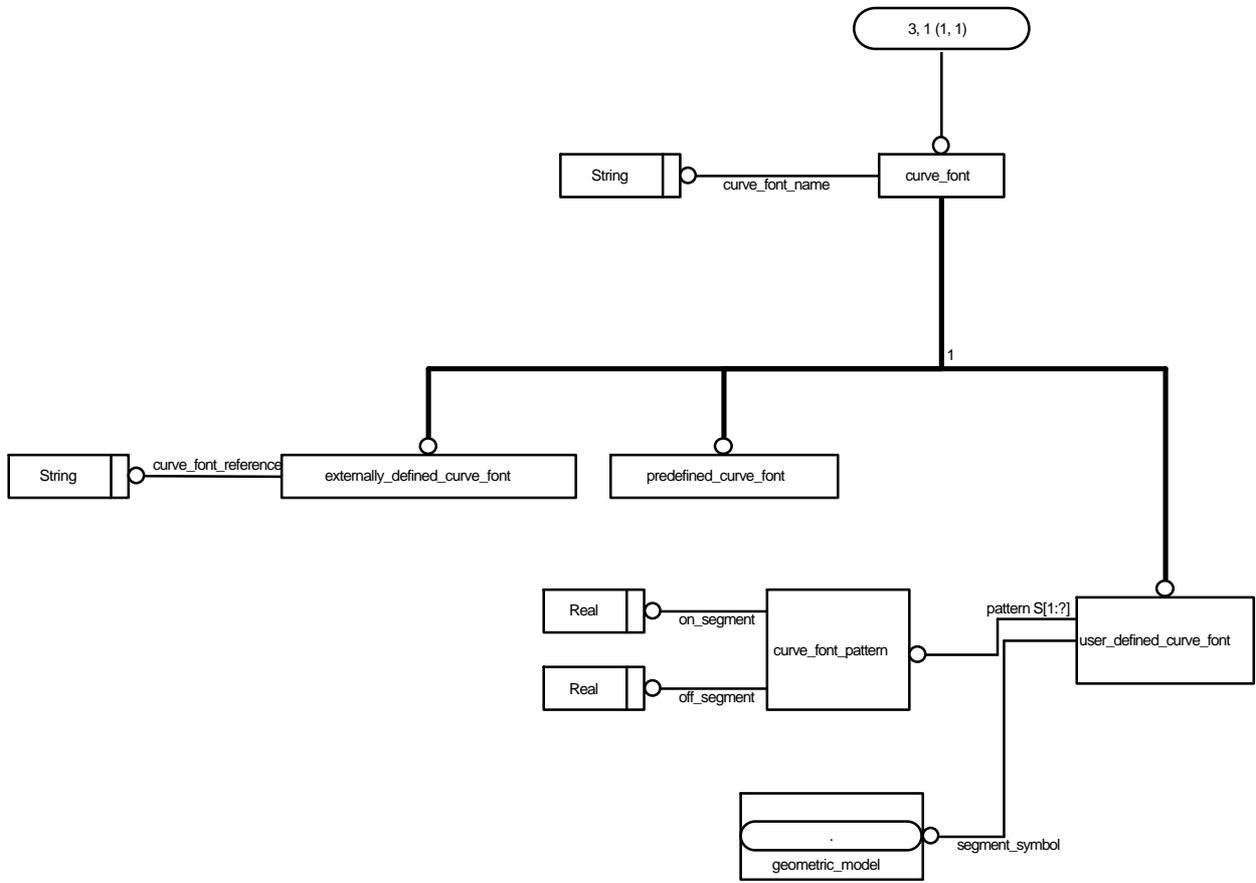


Figure C.2 - ARM diagram 2 of 3

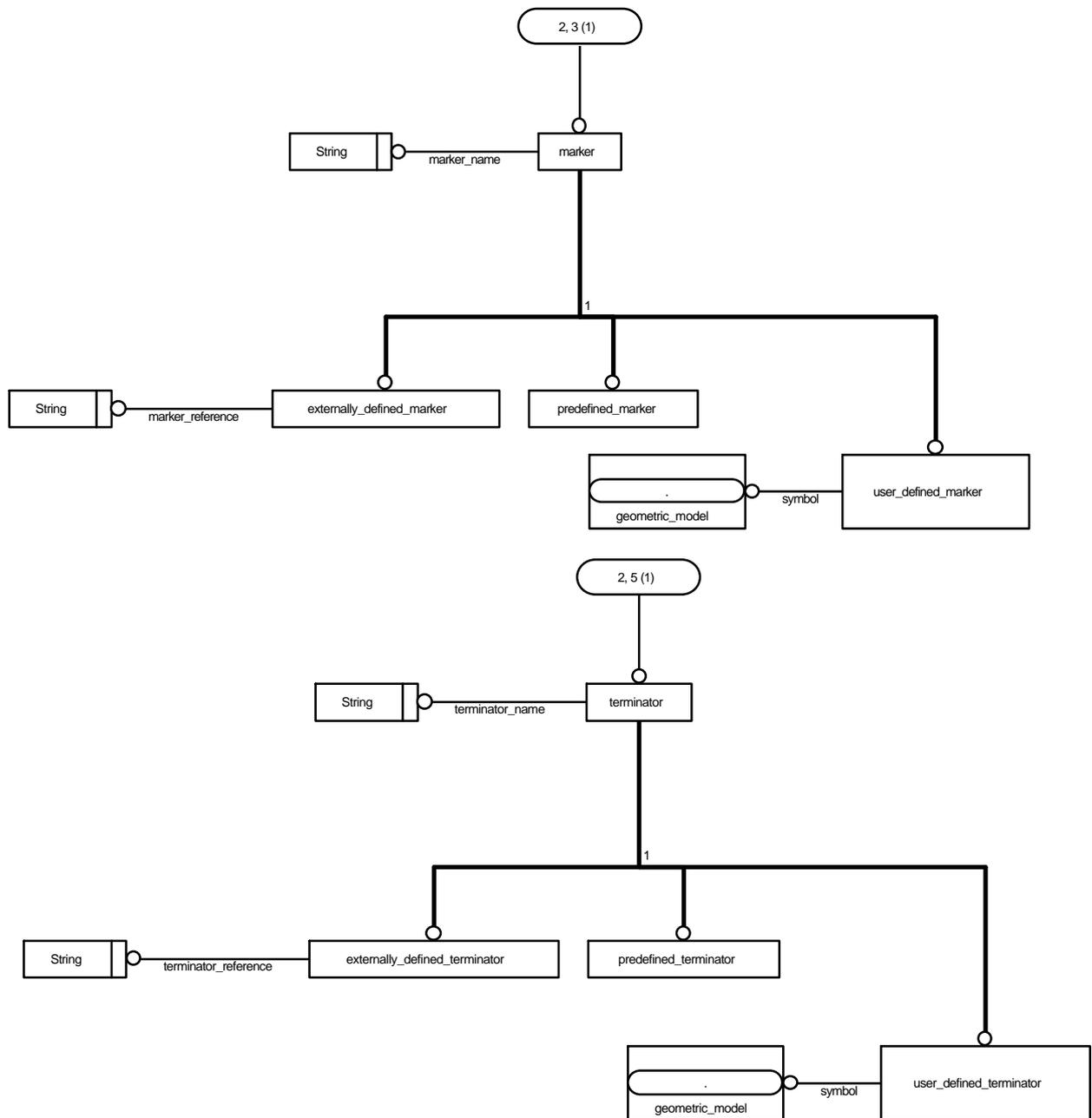


Figure C.3 - ARM diagram 3 of 3

Annex D
(informative)
MIM EXPRESS-G

The following diagrams correspond to the MIM EXPRESS given in Clause 5.2. The diagrams use the EXPRESS-G graphical notation for the EXPRESS language. EXPRESS-G is defined in annex A of ISO 10303-11. Note that the inter-page referencing is to the diagram number and not the figure number.

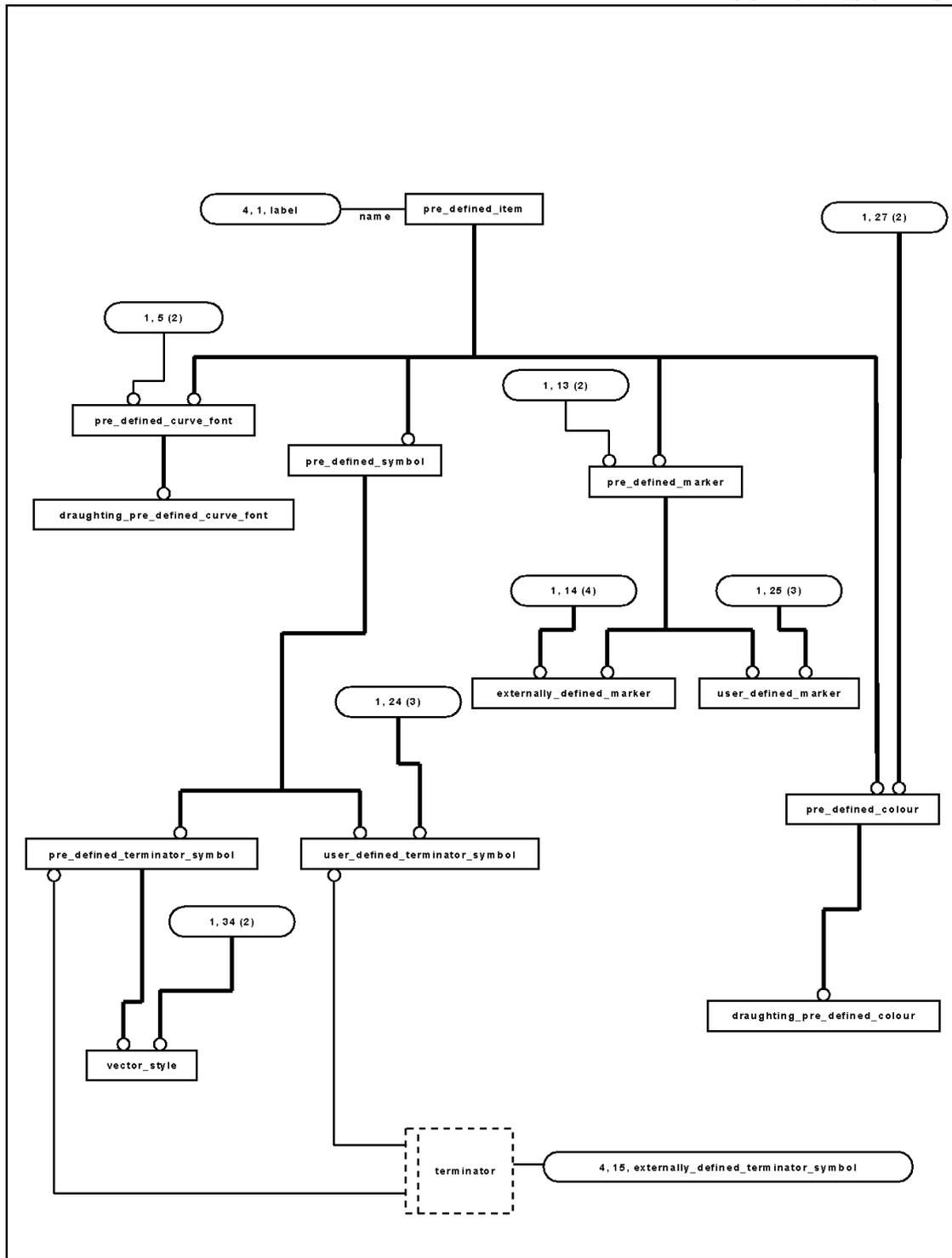


Figure D.1 - MIM EXPRESS-G diagram 1 of 4

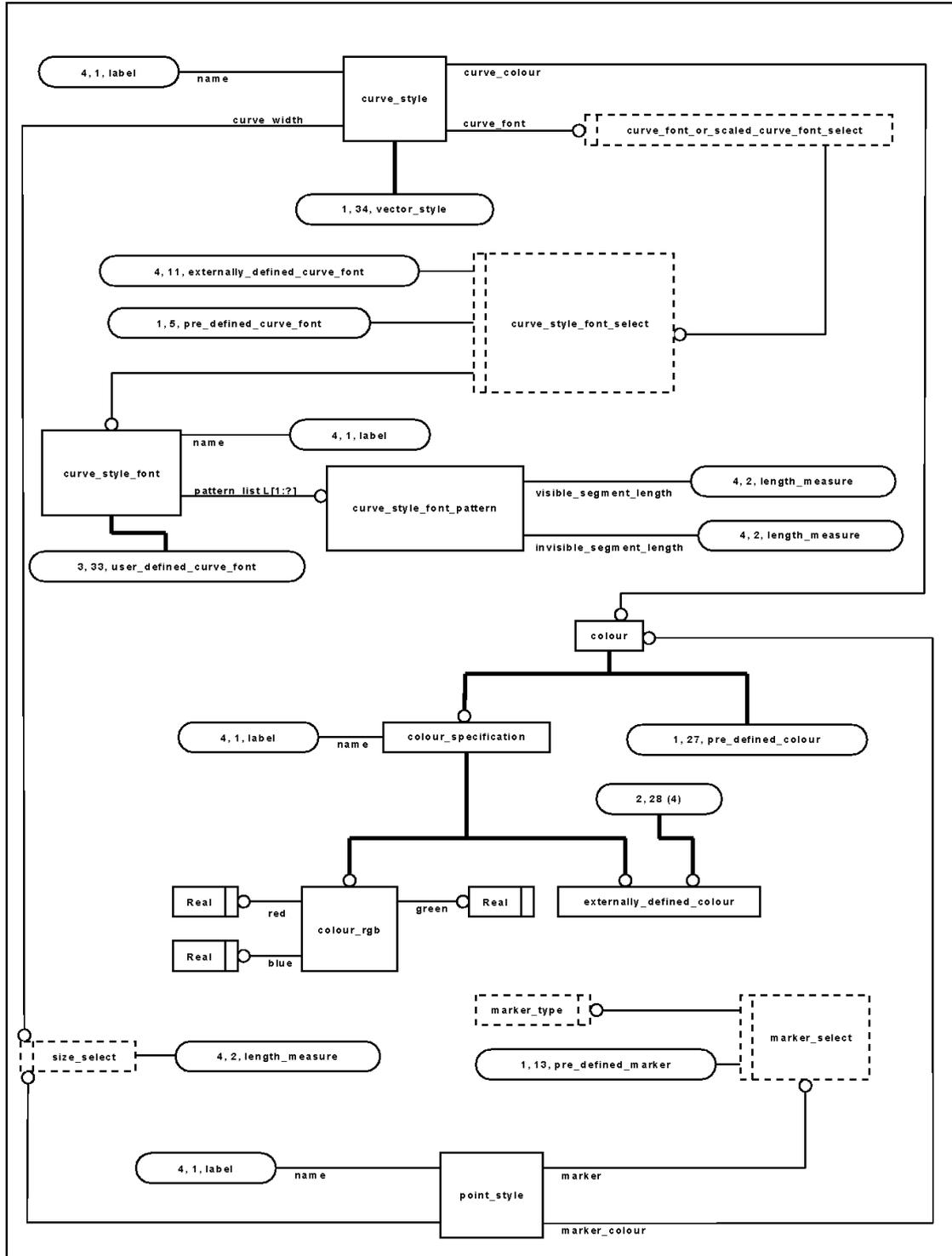


Figure D.2 - MIM EXPRESS-G diagram 2 of 4

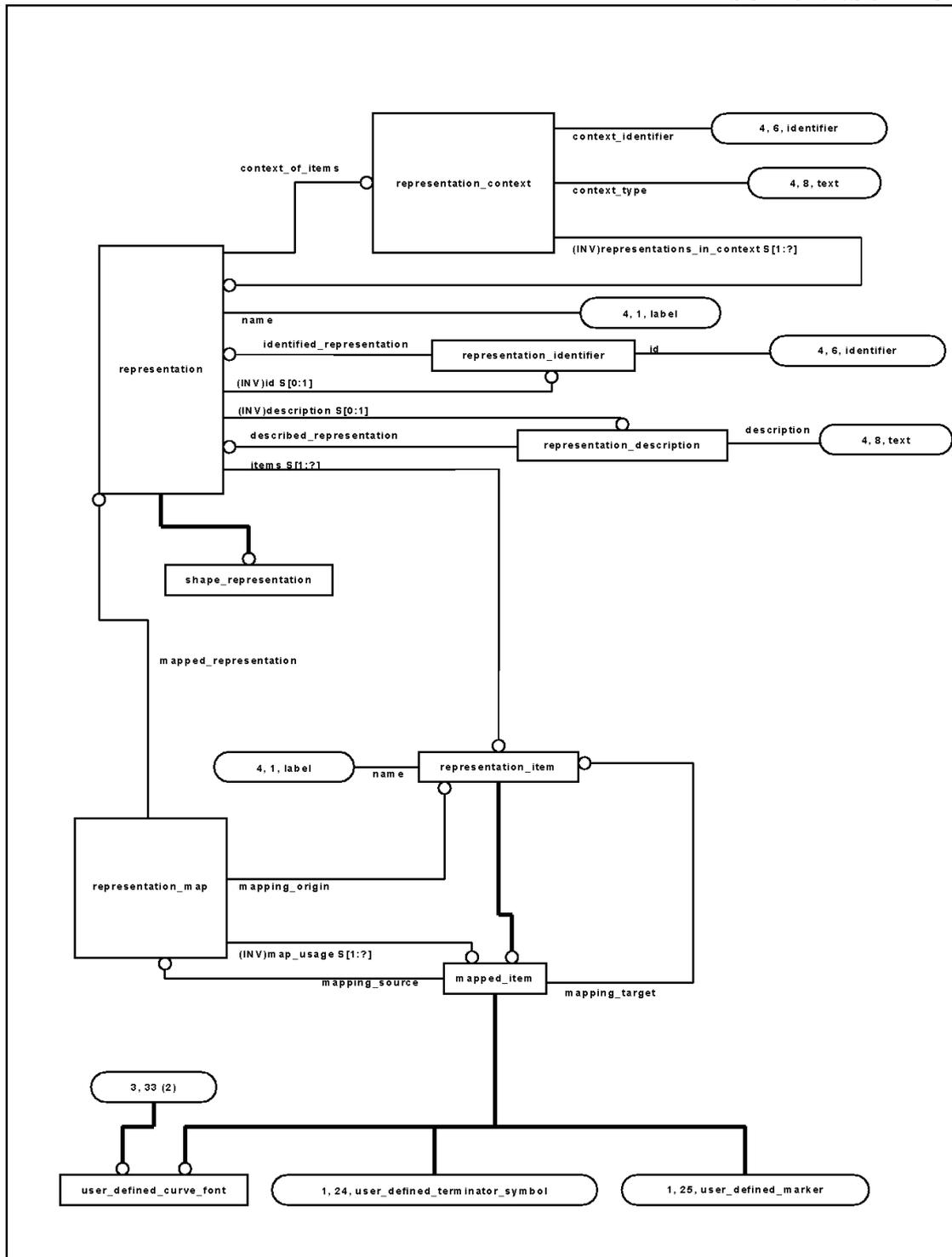


Figure D.3 - MIM EXPRESS-G diagram 3 of 4

Annex E

(informative)

AM ARM and MIM EXPRESS

This annex provides a listing of the EXPRESS for the ARM specified in clause 4 and expanded EXPRESS schema specified in clause 5.2 of this part of ISO 10303 without comments or other explanatory text. It also provides a listing of the EXPRESS entity names and corresponding short names as specified in annex B of this part of ISO 10303. The content of this annex is available in computer-interpretable form and can be found at the following URLs:

ARM: <ftp://pdes.scra.org/pub/modules/ca/arm.exp>

EXPRESS: <ftp://pdes.scra.org/pub/modules/ca/mim.exp>

Short names: <ftp://pdes.scra.org/pub/modules/ca/sn.txt>

If there is difficulty accessing these sites contact ISO Central Secretariat or contact the ISO TC 184/SC4 Secretariat directly at: sc4sec@cme.nist.gov.

NOTE - The information provided in computer-interpretable form at the above URLs is informative. The information that is contained in the body of this part of ISO 10303 is normative.

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Annex F
(informative)

Application module implementation and usage guide

Annex G
(informative)
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